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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/819,762	03/29/2001	Yoshiki Sakuma	010401	2685

23850 7590 06/04/2003

ARMSTRONG, WESTERMAN & HATTORI, LLP
1725 K STREET, NW
SUITE 1000
WASHINGTON, DC 20006

EXAMINER

BAUMEISTER, BRADLEY W

ART UNIT	PAPER NUMBER
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2815

DATE MAILED: 06/04/2003

16

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.
09/819,762

Applicant(s)
Sakuma et al.

Examiner
B. William Baumeister

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2815



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Mar 18, 2003
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-8 and 11-18 is/are pending in the application.
- 4a) Of the above, claim(s) 3 and 12-18 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 2, 4-8, and 11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____ 6) ☐ Other: _____

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DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
2. Claims 1, 2, 4-8 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over JP '834 in view of Furukawa '614.
 - a. JP '834 discloses Si-based HBTs formed on a Si substrate wherein Ge is alloyed with the Si in the emitter, base and collector regions for the purpose of decreasing the lattice misfit of the regions (Abstract and FIGs). In the embodiment of FIG 1, the Ge content continuously increases in the base layer in the direction of the collector and has a non-zero Ge composition at the emitter interface of the base. See further in FIGs 1(a)-(e) that the emitter has two portions: an upper emitter portion distal from the base containing no Ge and a lower emitter portion adjacent the base (or an "interface layer" of claim 1) having a Ge content that increases towards the base. Similarly, the collector has a lower portion containing no Ge (note FIGs 1(c)-(e) wherein the right-hand portion of the collector bandgap is constant indicating that the collector extends beyond the point that Ge is alloyed with the Si) and an upper portion adjacent the base (or "another interface layer" of claim 11) having a Ge concentration that increases towards the base. JP '834 does not teach employing SiGeC alloys in the embodiment of FIGs 1(a)-(e).

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b. Furukawa '614 teaches that C can be added to SiGe in a Ge:C constant-ratio range of about 6.7/1 to 12/1 (e.g., claim 1) for Si concentrations ranging from about 90% to 0 % (e.g., col. 7, lines 50-54) for the purpose of reducing the lattice strain between SiGe/Si heterointerfaces and thereby inhibiting resultant lattice defects. Furukawa specifically teaches that this concept may be employed for Group IV HBT formed on a Si substrate having a SiGeC base and that the resultant base bandgap is smaller than that of the Si emitter and collector (e.g., col. 5 and FIG 4). Furukawa does not teach grading the Ge content of the SiGeC base.

c. It would have been obvious to one of ordinary skill in the art at the time of the invention to have added C to those portions of the JP '834 FIG 1-embodiment HBT that possess Ge (i.e., the base region and the two base-interface regions of the emitter and collector) in a corresponding C:Ge ratio as taught by Furukawa for the purpose of reducing the device's lattice strain and increasing the degree of design freedom in adjusting the various region's bandgaps as desired.

d. Regarding the claimed Si substrate (claim 2), FIG 1 shows the collector formed with a bottom collector electrode 14, as opposed to on a Si substrate. Furukawa teaches that SiGe-based HBTs can alternatively be grown on Si substrates. It would have been obvious to one of ordinary skill in the art at the time of the invention to alternatively form SiGe-based HBTs on a Si substrate so that the HBT can be monolithically integrated with other components on a common substrate.

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Response to Arguments

3. Applicant's arguments filed 3/18/2003 have been fully considered but they are not persuasive.

a. In response to applicant's argument that neither of Furukawa and JP '834 addresses the problem of spike formation, the fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985).

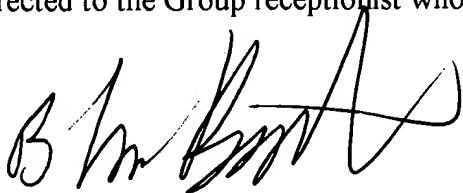
b. In response to applicant's argument that JP '834 is based on a wrong knowledge about the affects of incorporating C into SiGe compounds, the rejection was not based on that reference's discussion of C incorporation. Rather, the motivation to include C in the SiGe regions of JP '834 was based on the teachings of Furukawa.

c. In response to applicant's argument that FIG "1(b) of JP '834 is a band diagram and the inclined curve for the base layer is not the compositional profile of C in the base layer," the Examiner agrees that the embodiment of FIG 1(b) does not teach including C in the base. Rather, as was explained, the addition of C to this region was based upon the teachings of Furukawa.

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INFORMATION ON HOW TO CONTACT THE USPTO

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister**, at **(703) 306-9165**. The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Eddie Lee, can be reached at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

A handwritten signature in black ink, appearing to read 'B. William Baumeister', with a stylized, cursive script.

B. William Baumeister

Patent Examiner, Art Unit 2815

May 31, 2003